Claims

1. Frequency tracking device (FTD) for a receiver (RC) of a multi-carrier communication system (MC-SYS), for evaluating and correcting frequency deviations (f_{off}) which are introduced into multi-carrier symbols when being transmitted between a transmitter multi-carrier filter bank (4; IFFT) and receiver multi-carrier filter bank (8; FFT), comprising:

a) a selector (SEL) adapted to receive a set of N complex data symbols output by the receiver multi-carrier filter bank (8; FFT) and N channel coefficients (C_{est}) corresponding to each sub-carrier as estimated by a channel estimator (12) of said receiver (RC), where N is the number of used sub-carriers in the multi-carrier system (MC-SYS), and adapted to select, on the basis of the N channel coefficients (C_{est}), a number M of sub-carriers corresponding to the M channel coefficients (C_{est}) having the largest absolute values, where $M \leq N$;

b) an evaluator (EVAL) adapted to determine, on the basis of the M selected sub-carriers and their corresponding M channel coefficients (C_{est}), an estimate ($f_{off,est}$) of the frequency deviation (f_{off}) introduced into the multi-carrier symbols; and

c) a corrector (CORR1; CORR2) for correcting the frequency deviation introduced into the multi-

carrier symbols on the basis of the determined frequency deviation estimate ($f_{off,est}$).

2. Frequency tracking device (FTD) according to claim 1, wherein
said selector (SEL) adaptively adjusts the number M at adjustment time intervals including at least one multi-carrier symbol duration.

3. Frequency tracking device (FTD) according to claim 1, wherein
said corrector (CORR1; CORR2) includes a first correction unit (CORR1) arranged upstream the receiver multi-carrier filter bank (8) and adapted to rotate each received multi-carrier symbol with a different phase shift depending on the frequency deviation estimate ($f_{off,est}$) and the sample index (k) within the multi-carrier symbol.

4. Frequency tracking device (FTD) according to claim 1 or 3, wherein
said corrector (CORR1; CORR2) includes a second correction unit (CORR2) arranged downstream of the receiver multi-carrier filter bank (8) and adapted to rotate all data symbols output by the receiver multi-carrier filter bank (8) with the same phase shift depending on the frequency deviation estimate ($f_{off,est}$).

5. Frequency tracking device (FTD) according to claim 4, wherein

said second correction unit (CORR2) performs a correction of the same set of N data symbols which are subjected to the selection by said selector (SEL).

6. Frequency tracking device (FTD) according to claim 1, wherein
said corrector (CORR1; CORR2) includes:

a first correction unit (CORR1) arranged upstream the receiver multi-carrier filter bank (8) and adapted to rotate each received multi-carrier symbol with a different phase shift depending on the frequency deviation estimate ($f_{off,est}$) and the sample index (k) within the multi-carrier symbol; and

a second correction unit (CORR2) arranged downstream of the receiver multi-carrier filter bank (8) and adapted to rotate all data symbols output by the multi-carrier filter bank (8) with the same phase shift depending on the frequency deviation estimate ($f_{off,est}$).

7. Frequency tracking device (FTD) according to claim 1, wherein
said evaluator (EVAL) is adapted to carry out a decision directed evaluation for said M sub-carriers.

8. Frequency tracking device (FTD) according to claim 1, wherein
said evaluator (EVAL) is adapted to carry out a pilot carrier aided evaluation for said M sub-carriers.

9. Frequency tracking device (FTD) according to claim 1, wherein
said evaluator (EVAL) is adapted to carry out a combination of a decision directed evaluation and a pilot carrier aided evaluation for said M subcarriers.

10. Frequency tracking device (FTD) according to claim 1, wherein
the number of selected sub-carriers is M=N/4 to M=N/3 where N is the number of used subcarriers.

11. Frequency tracking device (FTD) for a receiver (RC) of a multi-carrier communication system (MC-SYS), for evaluating and correcting frequency deviations (f_{off}) which are introduced into multi-carrier symbols when being transmitted between a transmitter multi-carrier filter bank (4; IFFT) and receiver multi-carrier filter bank (8; FFT), comprising:

a) an evaluator (EVAL) adapted to receive a set of N complex data symbols output by the receiver multi-carrier filter bank (8; FFT) and N channel coefficients (C_{est}) corresponding to each sub-carrier as estimated by a channel estimator (12) of said receiver (RC), where N is the number of used sub-carriers in the multi-carrier system (MCSYS), and to determine, on the basis of N sub-carriers and their corresponding N channel coefficients (C_{est}), an estimate ($f_{off,est}$) of the frequency deviation (f_{off}) introduced into the multi-carrier symbols, where N is the number of sub-carriers used in the transmitter;

b) a corrector (CORR1; CORR2) for correcting the frequency deviation introduced into the multi-carrier symbols on the basis of the determined frequency deviation estimate ($f_{off,est}$); and

c) wherein said corrector (CORR1; CORR2) comprises a corrector unit (CORR2) arranged downstream of the receiver multi-carrier filter bank (8) and adapted to rotate all data symbols output by the receiver multi-carrier filter bank (8) with the same phase shift depending on the frequency deviation estimate ($f_{off,est}$).

12. Frequency tracking device (FTD) according to claim 11, wherein
said corrector (CORR1; CORR2) further includes a correction unit (CORR1) arranged upstream the receiver multi-carrier filter bank (8) and adapted to rotate each received multi-carrier symbol with a different phase shift depending on the frequency deviation estimate ($f_{off,est}$) and the sample index (k) within the multi-carrier symbol.

13. Frequency tracking device (FTD) according to claim 11, further comprising
a selector (SEL) adapted to receive a set of N complex data symbols output by the receiver multi-carrier filter bank (8; FFT) and N channel coefficients (C_{est}) corresponding to each sub-carrier as estimated by a channel estimator (12) of said receiver (RC), where N is the number of used sub-carriers in the multi-carrier system (MCSYS), and adapted to select, on the

basis of the N channel coefficients (C_{est}), a number M of sub-carriers corresponding to the M channel coefficients (C_{est}) having the largest absolute values, where $M \leq N$; and wherein

said evaluator (EVAL) is adapted to determine, on the basis of the M selected sub-carriers and their corresponding M channel coefficients (C_{est}), an estimate ($f_{off,set}$) of the frequency deviation (f_{off}) introduced into the multi-carrier symbols.

14. Receiver (RC) of a multi-carrier communication system (MC-SYS), comprising reception means (RM) for receiving multi-carrier symbols transmitted from a transmitter (TR) via a transmission channel (6), a receiver multi-carrier filter bank (8) for converting said multi-carrier symbols into complex data symbols, a data symbol sink (11) for receiving said data symbols and a frequency tracking device (FTD) in accordance with one or more of claims 1-10 or one or more of claims 11-13.

15. A multi-carrier communication system (MC-SYS), comprising at least one transmitter (TR) including a data symbol source (1-3) generating complex data symbols, a transmitter multi-carrier filter bank (4) for generating multi-carrier symbols from said complex data symbols and a transmission means (TR) for transmitting said multi-carrier symbols onto a transmission channel (6), and at least one receiver (RC) in accordance with claim 14.

16. A method for evaluating and correcting frequency deviations (f_{off}) which are introduced into multi-carrier symbols when being transmitted between a transmitter multi-carrier filter bank (4; IFFT) and receiver multi-carrier filter bank (8; FFT), comprising the steps of:

a) determining (S1; S2), in a receiver (RC) of a multi-carrier communication system (MC-SYS), a set of N complex data symbols output by the receiver multi-carrier filter bank (8; FFT) and N channel coefficients (C_{est}) corresponding to each sub-carrier as estimated by a channel estimator (12) of said receiver (RC), where N is the number of used sub-carriers in the multi-carrier system (MCSYS); and

b) selecting (S3), on the basis of the N channel coefficients (C_{est}), a number M of sub-carriers corresponding to the M channel coefficients (C_{est}) having the largest absolute values, where $M \leq N$;

c) determining (S4), on the basis of the M selected sub-carriers and their corresponding M channel coefficients (C_{est}), an estimate ($f_{off,est}$) of the frequency deviation (f_{off}) introduced into the multi-carrier symbols; and

d) correcting (S5) the frequency deviation introduced into the multi-carrier symbols on the basis of the determined frequency deviation estimate ($f_{off,est}$).

17. A method according to claim 16,
wherein
said correction step (S5) includes a first correction (CORR1) carried out upstream a receiver multi-carrier filter bank (8) in which each received multi-carrier symbol is rotated with a different phase shift depending on the frequency deviation estimate ($f_{off,est}$) and the sample index (k) within the multi-carrier symbol.

18. A method according to claim 16,
wherein
said correction step (S5) includes a second correction (CORR2) carried out downstream a receiver multi-carrier filter bank (8) in which all data symbols output by the receiver multi-carrier filter bank (8) are corrected with the same phase shift depending on the frequency deviation estimate ($f_{off,est}$).

19. A method according to claim 16,
wherein
said correction step (S4) includes:

a first correction (CORR1) carried out upstream a receiver multi-carrier filter bank (8) in which each received multi-carrier symbol is rotated with a different phase shift depending on the frequency deviation estimate ($f_{off,est}$) and the sample index (k) within the multi-carrier symbol; and

a second correction (CORR2) carried out downstream a receiver multi-carrier filter bank (8) in which all

data symbols output by the receiver multi-carrier filter bank (8) are corrected with the same phase shift depending on the frequency deviation estimate ($f_{off,est}$).

20. A method for evaluating and correcting frequency deviations (f_{off}) which are introduced into multi-carrier symbols when being transmitted between a transmitter multi-carrier filter bank (4; IFFT) and receiver multi-carrier filter bank (8; FFT), comprising the steps of:

a) determining (S1', S2'), in a receiver (RC) of a multi-carrier communication system (MC-SYS), a set of N complex data symbols output by the receiver multi-carrier filter bank (8; FFT) and N channel coefficients (C_{est}) corresponding to each sub-carrier as estimated by a channel estimator (12) of said receiver (RC), where N is the number of used sub-carriers in the multi-carrier system (MCSYS), and

b) determining (S3'; S4'), on the basis of N sub-carriers and their corresponding N channel coefficients (C_{est}), an estimate ($f_{off,est}$) of the frequency deviation (f_{off}) introduced into the multi-carrier symbols, where N is the number of sub-carriers used in the transmitter; and

c) correcting (S5') the frequency deviation (f_{off}) introduced into the multi-carrier symbols on the

basis of the determined frequency deviation estimate ($f_{off,est}$); and

c) wherein said correction step (S3') comprises a correction (CORR2) carried out downstream of the receiver multi-carrier filter bank (8) in which all data symbols output by the receiver multi-carrier filter bank (8) are rotated with the same phase shift depending on the frequency deviation estimate ($f_{off,est}$).

21. A method according to claim 20, wherein said correction step (S5') further includes a correction step (CORR1) carried out upstream the receiver multi-carrier filter bank (8) in which each received multi-carrier symbol is rotated with a different phase shift depending on the frequency deviation estimate ($f_{off,est}$) and the sample index (k) within the multi-carrier symbol.

22. A method according to claim 20, further including the steps of.
selecting (S2'), on the basis of the N channel coefficients (C_{est}), a number M of sub-carriers corresponding to the M channel coefficients (C_{est}) having the largest absolute values, where $M \leq N$; and wherein

determining (S4'), on the basis of the M selected sub-carriers and their corresponding M channel coefficients (C_{est}), an estimate ($f_{off,set}$) of the

frequency deviation (f_{off}) introduced into the multi-carrier symbols.